

What is claimed is:

1. A surface treating method, treating the surface of a member, comprising;

producing a cluster having the first molecule and the second molecule bonded together by an intermolecular force in a gas vapor phase, making the first molecule more reactive than the first molecule in case of not bonded with the second molecule by utilizing at least a part of internal energy released in producing the cluster; and

treating the surface of the member in a gas phase with the cluster containing the first molecule made in a state of higher reactivity.

2. The surface treating method according to claim 1, wherein the first molecule and the second molecule are different.

3. The surface treating method according to claim 1, wherein the second molecule acts as a catalyst to make the first molecule higher reactivity.

4. The surface treating method according to claim 1, wherein the first molecule is hydrogen peroxide molecule while the second molecule is water molecule.

5. The surface treating method according to claim 4, wherein the first molecule in higher reactivity contains oxywater.

6. The surface treating method according to claim 1, wherein the first molecule and the second molecule are supplied

so that their molar ratio near the surface of the member is made 1:3.

7. The surface treating method according to claim 1, wherein electromagnetic field is irradiated to the cluster in producing the cluster.

8. The surface treating method according to claim 7, wherein the energy of the electromagnetic field is 0.4 eV or more.

9. The surface treating method according to claims 1, making the first molecule higher reactivity near the surface of the member.

10. The surface treating method according to claim 1, wherein the first and the second molecules are supplied as a gas diluting the first molecule and a gas diluting the second molecule or as a mixed gas diluting the first and the second molecules to the surface of the member and microwave is applied to at least one of the gas diluting the first molecule, the gas diluting the second molecule and the mixed gas.

11. The surface treating method according to claim 10, wherein the frequency of the microwave is 3 GHz or more.

12. The surface treating method according to claim 10, wherein at least one of the gas diluting the first molecule, the gas diluting the second molecule and the mixed gas is a gas consisting of molecules having vibrational degrees of freedom of 60 or less.

13. The surface treating method according to claim 1, wherein the treating the surface of the member with the cluster includes oxidizing the surface of the member or the contamination adhered on the surface of the member.

14. The surface treating method according to claim 13, further comprising, treating the surface of the member using any of a gas having reactivity with an oxide or a chelating agent forming a chelate compound with metal after or together with treating the surface of the member with the cluster.

15. The surface treating method according to claim 1, further comprising, physically removing a residual product produced on the surface of the member by treating the surface of the member with the cluster.

16. The surface treating method according to claim 1, wherein treating the surface of the member with the cluster is at least one step selected from a group consisting of a step of cleaning the surface of the member, a step of forming a film on the surface of the member and a step of etching the surface of the member.

17. The surface treating method according to claim 1, wherein the member is a semiconductor substrate and treating the surface of the semiconductor substrate with the cluster is at least one step selected from a group consisting of a step of cleaning the surface of the semiconductor substrate, a step of forming a silicon oxide film on the surface of the

semiconductor substrate, a step of forming a metal oxide film on the surface of the semiconductor substrate, a step of forming a film by a chemical vapor phase deposition on the surface of the semiconductor substrate, a step of forming a film by a physical vapor phase deposition on the surface of the semiconductor substrate, a step of thermal treatment of the surface of the semiconductor substrate and a step of dry etching of the surface of the semiconductor substrate.

18. A surface treating method for a substrate comprising;  
producing a cluster having a first molecule and a second molecule bonded together by inter molecular forces, wherein the first molecule having a higher reactivity than that of the first molecule when it is not bonded with the second molecule which is different from the first molecule; and

treating a surface of the substrate with an atmosphere of said cluster containing at least the first molecule having the higher reactivity.

19. The surface treating method according to claim 18, wherein the first molecule made higher reactivity contains oxywater.

20. A surface cleaning method for the surface of a member, comprising;

producing a cluster having a hydrogen peroxide molecule and a water molecule bonded together by an inter molecular force in a vapor phase; and

cleaning the surface of the member in a vapor phase with  
the cluster.